CERES meeting October 22-26th

Karouche Nadia : CNES chef de projet Megha -Tropiques

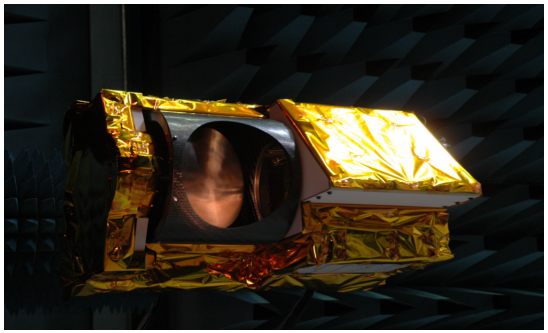
MEGHA - TROPIQUES

MEGHA –TROPIQUES is a scientific mission dedicated to the study of the atmospheric water cycles, energy exchanges and convective systems in the inter-tropical belt

MEGHA -TROPIQUES is a joint ISRO/CNES program based on the development of one unique satellite launched by PSLV in iNDIA

Key interest : inclined orbit 20° wrt to equator and altitude 865,5Km

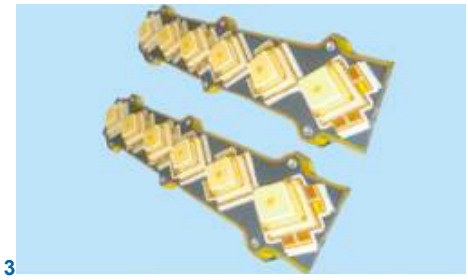
MEGHA-TROPIQUES PAYLOADS



SAPHIR

SCARAB

MARFEQ/MADRAS



GPS-ROSA

Bus : IRS from ISRO

Payload : 4 payloads

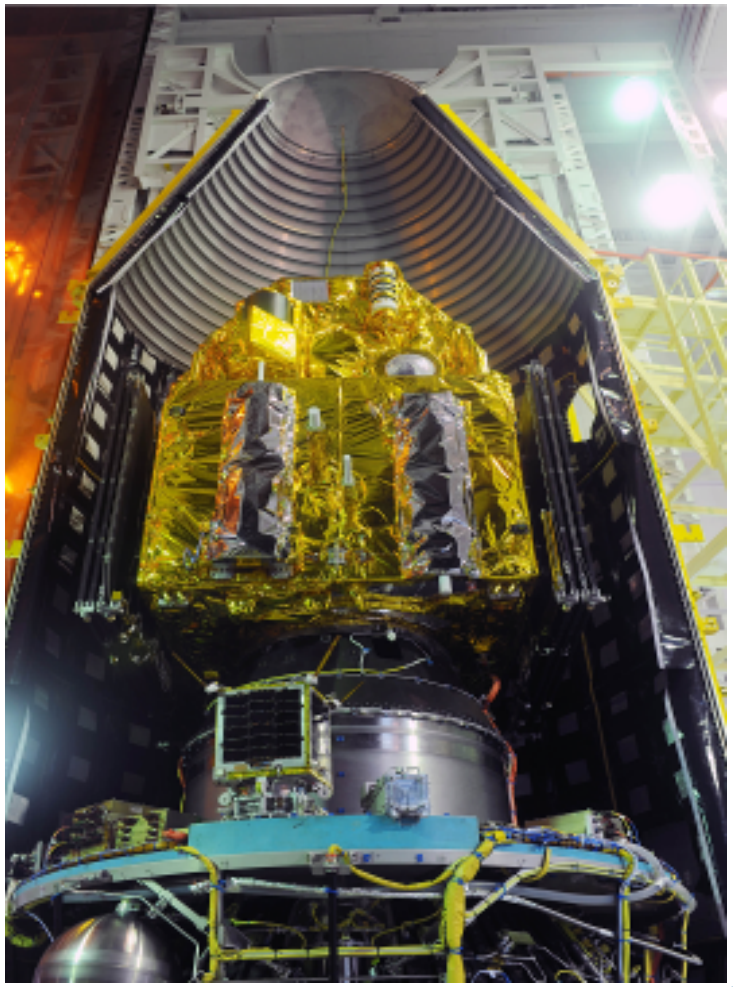
- **MADRAS (CNES/ISRO)**
- **SAPHIR (CNES)**
- **SCARAB (CNES)**
- **GPS-ROSA (ISRO)**

- ***Mass : 1 ton***
- ***Power : 694 Watts***
- ***Life time spec : 3 years***
- **Fuel > 5 years**

Launch
in October 2011

MEGHA-TROPIQUES satellite was launched Octobre 12th 2011 at 11Hours local time (5H30 UT) by indian PSLV launcher from SRIHARIKOTA in INDIA

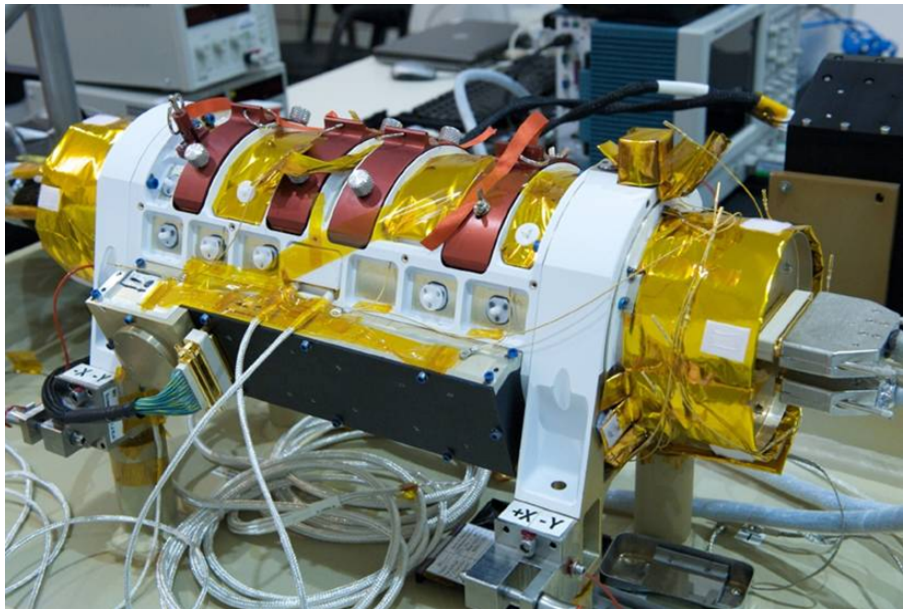
Launch was successful and orbit nominal



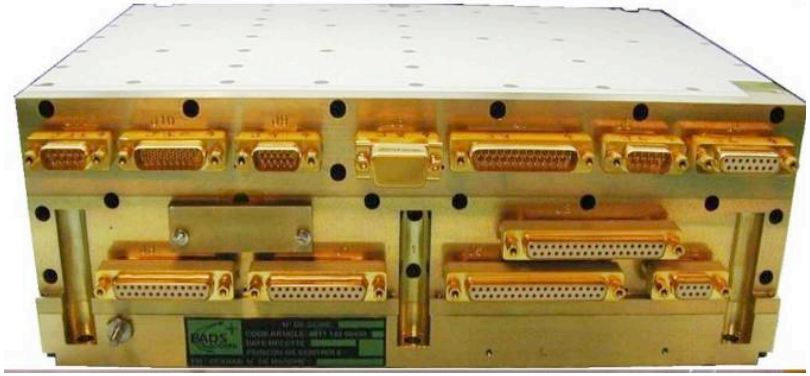
MEGHA - TROPIQUES

CNES Contribution : SCARAB

Instrument devoted to the Measurement of outgoing radiative fluxes at the top of the atmosphere



SCARAB OPTICAL HEAD for MEGHA-TROPIQUES



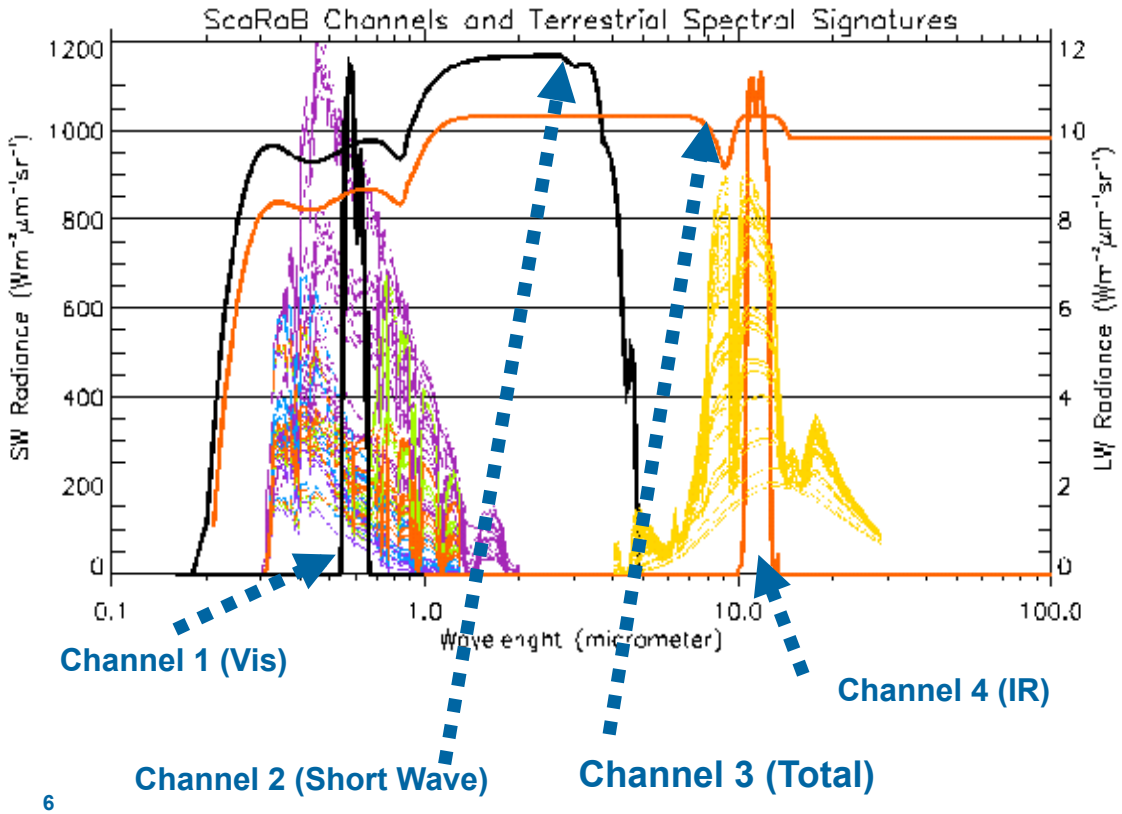
SCARAB Electronic module :

MEGHA-TROPIQUES

SCARAB estimates :

the solar reflected fluxes & the long wave emitted flux of the Earth/Atmosphere.

Channels spectral responses



2 broadband channels

- short wave (up to 4 mm) to measure direct Solar reflection
- Total channel to measure both direct Solar reflection and earth/atmosphere emitted radiation

2 Visible and Infrared windows channels (auxiliary narrow channels

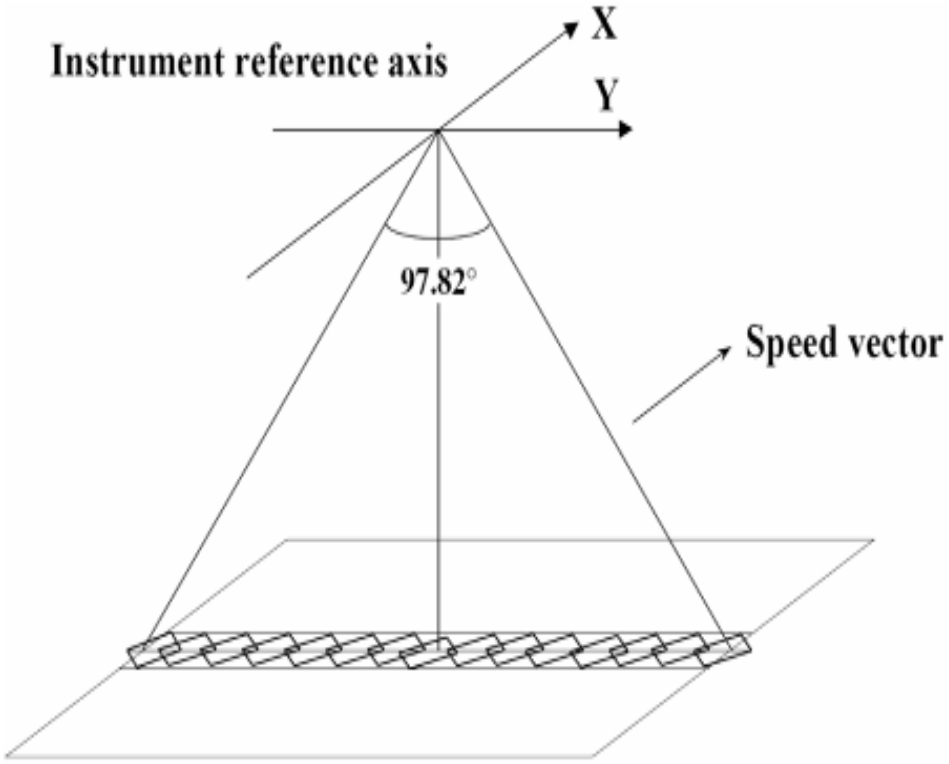
- To permit scene identification and comparison with geostationary satellites

SCARAB CHANNEL REQUIREMENTS

Channel	Wave length	Signal dynamics	Noise
Sc 1 -Visible	0,5 to 0,7 µm	120 $W.m^2.sr^{-1}$	< 1 $W.m^2.sr^{-1}$
Sc 2 - Solar	0,2 to 4 µm	425 $W.m^2.sr^{-1}$	< 0,5 $W.m^2.sr^{-1}$
Sc3 - Total	0,2 to 200 µm	500 $W.m^2.sr^{-1}$	< 0,5 $W.m^2.sr^{-1}$
Sc 4 - IR Window	10,5 to 12,5 µm	30 $W.m^2.sr^{-1}$	< 0,5 $W.m^2.sr^{-1}$

- ⇨ Main channels : Solar channel Sc2 and Total Sc3
- ⇨ Sc1 (visible)and Sc4 (IR)are used for scene identification and for compatibility with operational satellites : absolute accuracy
- ⇨ Longwave irradiance is calculated from the difference between Sc3 and Sc2
  - ⇨ Channel 5 : LW = Channel 3 – A * Channel 2 => Thermal energy
  - ⇨ Channel 5 is a synthetic channel
- ⇨

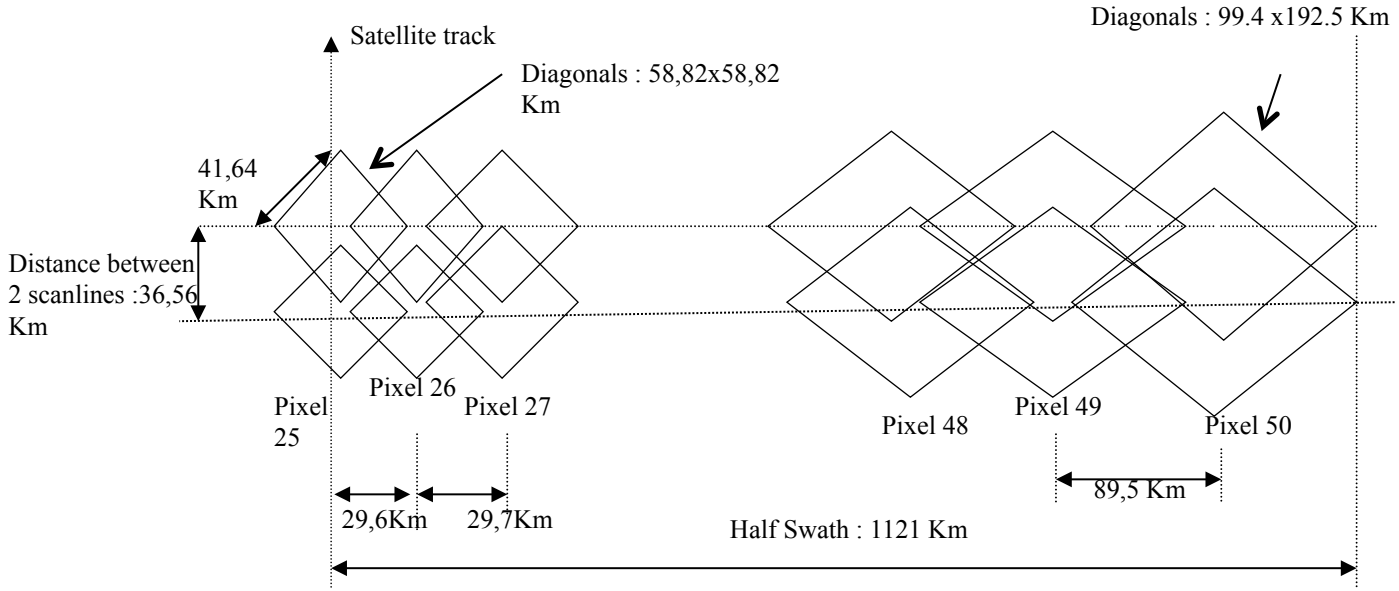
SCARAB is a cross track scanning radiometer



Main Requirements

- Scan angle coverage : ±49°
- Footprint at Nadir is 41Km
- Swath is about 2240 Km
- Location requirement : 5km
- Co-registration for C2/C3 : 98%

SCARAB Pixel pattern on ground



Centre of pixel 1 : -48.91°

Centre of pixel 51 : +48.91°

	At Nadir	Pixel 0 and N°50
Pixel size diagonal across track	58,82 Km	192,53 Km
Pixel size diagonal along track	58,82 Km	99, 46 Km

Instrument General Principle

- 4 Channels based on 4 identical telescopes focusing radiation on 4 pyroelectric detectors located at the prime focus of a spherical aluminum mirror

- The 4 channels are mounted on rotating scan support to realize cross track scanning

- Channel 1, 2 and 4 are equipped with filters
  - » Channel 1 and 4 : filters are mounted on the channel
  - » Channel 2 : filter is implemented on filter wheel

- A filter wheel is implemented to enable filters to be moved in front of channel 2 (nominal mode) or in front of channel 2 and 3 (calibration modes)

Instrument General Principle

- Detectors being sensitive to modulated energy, mechanical choppers are used to measure alternately the signal coming from earth and signal coming from internal blackbody reference
- A calibration Unit, composed of 3 blackbodies and a lamp is dedicated to in flight gain calibration
- During each scan period, a space view measurement is performed to provide a reference
- Acquisition pattern in nominal mode is composed of 4 phases : constant speed for earth acquisition, stop on deep space , acceleration and deceleration on the remaining period
- Total period or a scan = 6 seconds

INSTRUMENT MODES

Nominal : Solar Filter is set on channel 2 and no filter on total channel

: acquisition pattern with stop on space view channel2,3,4 and internal reference for channel 1

Solar Mode - Mode MS : Filter wheel is oriented in order to set 2 identical solar filters on channel 2 and channel 3

Total mode – Mode MT : Filter wheel is oriented such as no filter are located in front of channel 2 and 3

Mode CAL C : measurements of blackbodies and lamp are acquired – These measurements are used for gain calibration

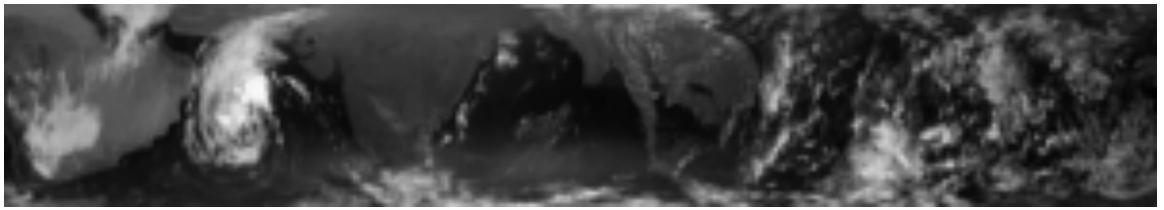
First switch ON :

Switch ON in stand by mode October 13th puis 3 semaines d'attente

Switch to nominal mode November 4th 2011,

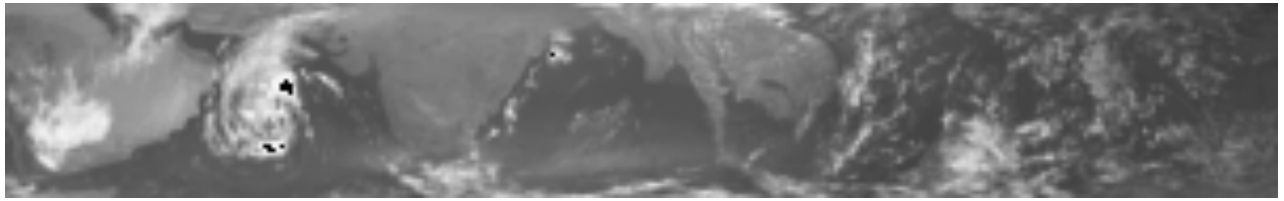
Nominal performance since launch

C1: Visible



C2: Solar

C3: Total



C4 : Infrared

SCARAB : L1 data processing

Products generated from CNES algorithms Specifications, and disseminated from ISRO mission center

Standard Product : Day-wise Product : Latency – 6 hours typical

Near Real Time Product : Dump-wise Product : Latency - 3hours 30

Product L1A :

51 pixels in scan line geometry

with Radiometric corrections

time tagged - Geolocated (including geometric corrections)

Product L1A2

Same à L1A plus better registration of channels with reference to channel 2 by interpolation

SCARAB : L1 data processing

Product L1A3 : collocated SCARAB data with MADRAS

Projection of scarab information ON MADRAS 89GHz channel geometry (conical scan)

Product L1B : **Projection on ISRO Grid static grid along the orbits**

Data dissemination

- **Products availability at L1 level in ISRO MOSDAC and ICARE centre Lille was delayed due to delay in data processing development**

- **July 26th 2012 : L1 A dump product disseminated in routine mode**

- **September 18th 2012 : L1A and L1A2 dump products disseminated in routine mode**

  - **Including some improvement in location processing**

- **Reprocessing of One year data going on, in ISRO with the objective to be disseminated by October End 2012**